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# INTERNATIONAL MOBILITY OF CANADIAN GRADUATE STUDENTS:

## AN INVESTIGATION INTO BRAIN DRAIN

# International Mobility of Canadian Graduate Students:
## An Investigation into Brain Drain


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## INTRODUCTION

The term ‘brain drain’ refers to the permanent outflow of highly educated and skilled individuals such as researchers, technologists, and experts, out of the country in pursuit of better opportunities abroad. Historically, this phenomenon has led to a loss of intellectual and human capital exerting a profound influence on the nation's workforce, impeding economic growth, and directly shaping the innovation landscape.

In the contemporary landscape of Canada's intellectual and economic growth, graduate students play a pivotal role. While working as graduate students they perform much of academic research - working closely with professors and other more senior researchers to push the frontier of human knowledge. Once completing these programs these highly qualified personnel may continue in academia as a postdoctoral scholar or move into the wider economy bringing their skills and expertise with them.

Their commitment to research and development not only fuels economic growth but also spawns novel enterprises, generates employment opportunities, and elevates productivity. Notably, Canada’s rich history of impactful innovations, exemplified by discoveries like insulin, underscores the importance of Canadian research and discovery in shaping the nation's identity and global influence.

In this survey conducted by the Ottawa Science Policy Network, we delve into the dynamics surrounding the departure of graduate students from Canada. We explore the motivations driving their decisions to leave, with a specific focus on the impact of financial considerations and the role of scholarships. Additionally, we consider the plans and reasoning of international students, offering a comparative lens to improve our understanding. As our investigation extends beyond national borders, we provide a global context, shedding light on where these departing students are heading and international comparisons of remuneration for academic researchers.

## SURVEY DEMOGRAPHICS

Our survey received a total of 582 responses, comprised of 411 students currently enrolled in a graduate program at a Canadian university, and 171 respondents who recently (within the past 10 years) completed a graduate program at a Canadian university. Of the current students, 293 are enrolled in a PhD program and 116 in a Masters program and 26% are international students. Of the recent graduates, the majority (60%) graduated between the years of 2020-2023. Entering the workforce was the most common position currently held by recent graduates (42%), followed by postdoctoral scholar (35%) and faculty/teaching positions (17%). For both recent graduates and current students, life sciences was the most common field of study (39%) followed by medical sciences (24%), physical sciences (23%), social sciences (8%), computer sciences (3%) and arts and humanities (3%).

## INTENT TO LEAVE

A substantial portion of respondents either have left or are considering leaving Canada (Fig. 1). Of students currently enrolled in a graduate program, 64% indicated they were likely or very likely to leave Canada following completion of their degree. 36% of recent graduates have left Canada following their degree, 15% intend to leave Canada, and 49% do not intend to leave Canada. The proportion of those reporting a desire to leave or who have already left are likely to be somewhat elevated due to a response bias to this survey, however they do indicate that large numbers of graduate students and those who have completed graduate studies are seriously considering moving away from Canada.

Of the recent graduates who have left Canada, the majority are pursuing a postdoctoral fellowship (46%) or are in a faculty/teaching position (26%) whereas 23% entered the workforce. Comparatively, those who remained in Canada were more likely to enter the workforce (54% of those who intend to stay in Canada and 46% of those who intend to leave Canada) and less likely to pursue postdoctoral scholarships (26% of those who intend to stay in Canada; 38% of those who intend to leave Canada) or faculty/teaching positions (14% of those who intend to stay in Canada, 4% of those who intend to leave Canada) (Fig. 2).

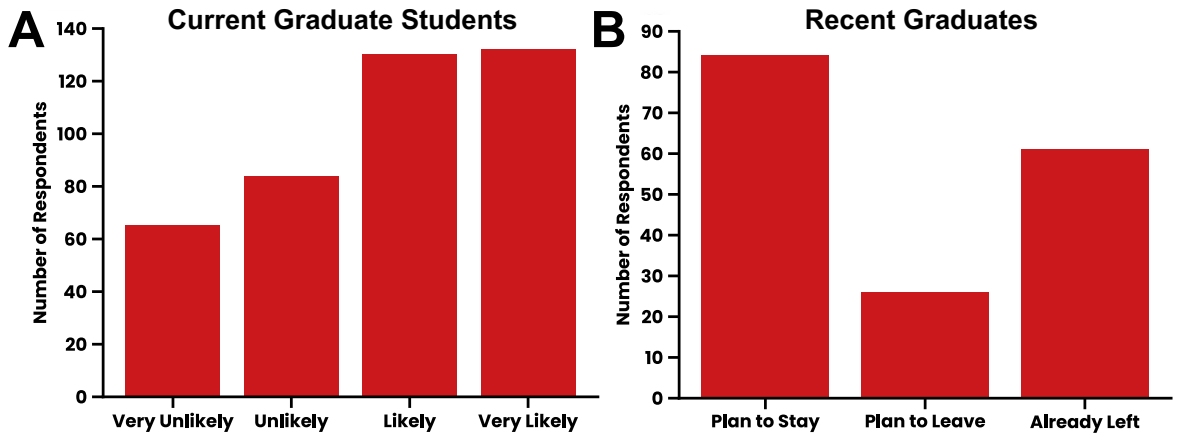



***Figure 1. Likelihood of graduate students to leave Canada.*** A) The proportion of current graduate students reporting their likelihood of leaving Canada following completion of their degree. B) The proportion of recent graduates by whether they have left or intend to leave Canada.

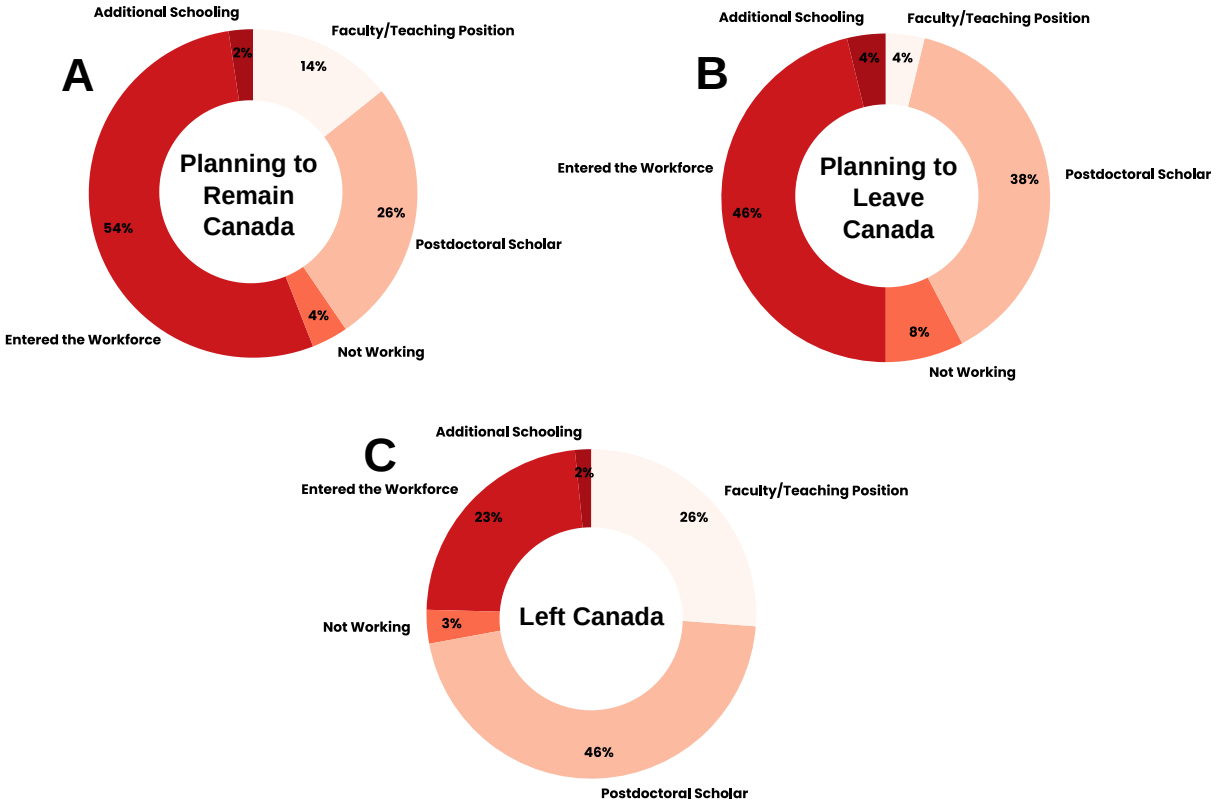



***Figure 2. The current position of recent Canadian graduates.*** Current positions held by A) those who are currently in Canada and intend to remain, B) those in Canada who intend to leaving and C) those who have left Canada.

## FACTORS FOR LEAVING

What drives so many graduate students to look beyond Canada for their futures? A key part of this survey was to determine which factors graduate students were most concerned about and had the biggest effect on their career choices. Survey respondents were asked to score from 1-5 (1 being the least important, 5 being the most important) the extent to which various factors influenced their decision to leave or stay in Canada (Fig. 3).

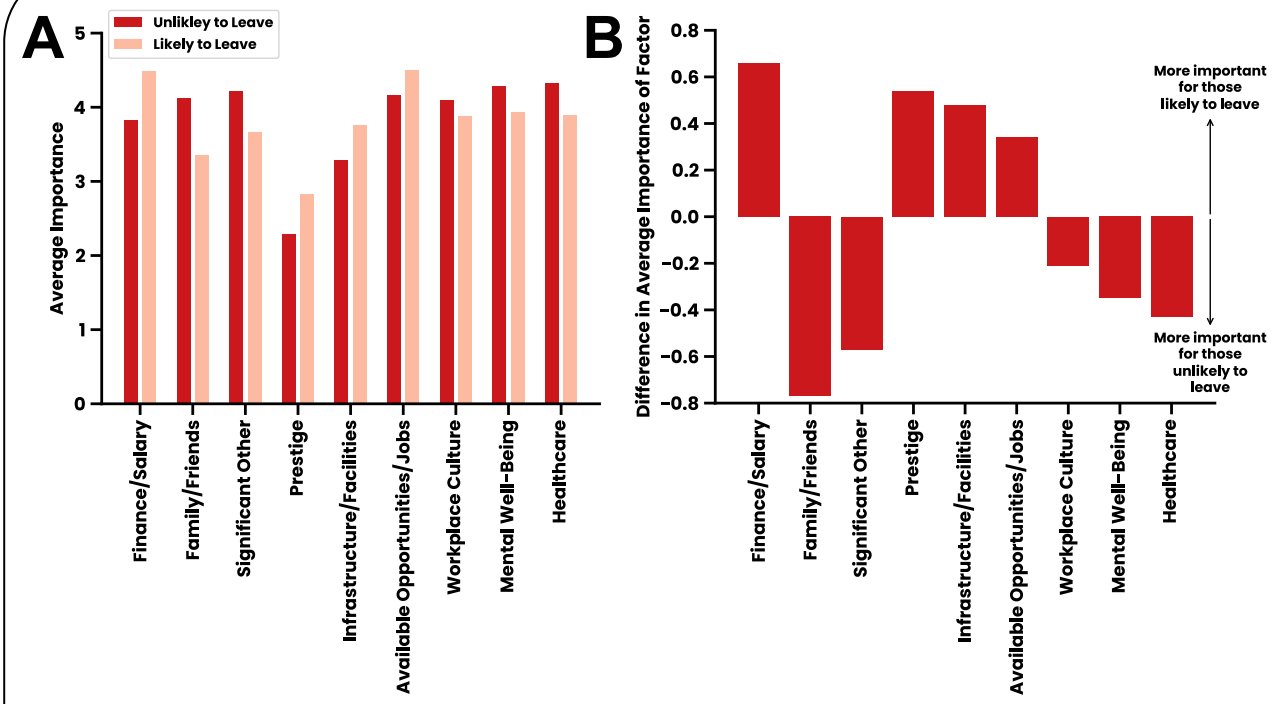



***Figure 3. Importance of various factors in graduate student decisions to leave or stay in Canada.*** A) Average importance and B) the difference in average importance between those two groups. Factors were scored on a scale of 1-5, where a score of 1 was unimportant and 5 was very important. Responses of "likely" and "very likely" were grouped together, as were "unlikely" and "very unlikely". For each factor except "Workplace Culture", the difference in average score between "leaving" and "staying" groups was significant.

Between those likely to leave and those unlikely to leave, the former scored "Available Opportunities/Jobs", "Finances/Salary", and "Infrastructure/Facilities" the highest. Conversely, those unlikely to leave Canada rated all other factors more highly, with the largest differences in scoring being "Family/Friends", "Significant Other", and "Healthcare". The factor "Available Opportunities/Jobs" was scored highest on average, while "Prestige" was the lowest average score overall.

This suggests that those graduate students who leave are incentivised towards financial stability and academic institutional reputation more than any other listed factor. By contrast, those who stay are driven mainly by their social connections with partners, families, and friends.

Those patterns remain when considering those who have recently completed graduate studies. Those who have left Canada or plan to do so both scored "Available Opportunities/Jobs" and "Finances/Salary" higher on average than other factors, whereas the highest-scored factors on average were "Significant Other", "Healthcare", and Family/Friends" for those planning to stay in Canada (Table 1).

***Table 1. The three highest-scored factors (on average) by recent graduates current status in Canada.***

| Left | Planning to Leave | Planning to Remain |
|---|---|---|
| Available Opportunities/Jobs (4.6) | Available Opportunities/Jobs (4.7) | Significant Other (4.5) |
| Finances/Salary (4.3) | Finances/Salary (4.6) | Healthcare (4.1) |
| Infrastructure/Facilities (3.6) | Mental Well Being (4.4) | Family/Friends (4.1) |

Interestingly, the gender of the survey respondents appeared to also have an influence on which three factors scored highest (Table 2). Respondents from all categories valued "Available Opportunities/Jobs" highly, but respondents self-identifying as women or agender/non-binary/gender-fluid both valued "Healthcare" and "Mental Well-Being" higher than other factors. Men scored "Finances/Salary" on average higher than any other gender, which suggests that they are more willing or able to move abroad for the sake of financial stability and career opportunities.

***Table 2. The three highest-scored factors (on average) by graduate students' self-declared gender, categorised as "Woman", "Man", "Agender", "Gender-Fluid", and/or "Non-Binary".***

| Woman | Man | Agender/Gender-Fluid/Non-Binary |
|---|---|---|
| Available Opportunities/Jobs (4.3) | Available Opportunities/Jobs (4.5) | Healthcare (4.1) |
| Healthcare (4.2) | Finances/Salary (4.4) | Mental Well Being (4.1) |
| Mental Well Being (4.2) | Workplace Culture (3.8) | Available Opportunities (4.0) |

## IMPACT OF FINANCE

Future financial stability was the most important decision factor incentivising students to consider leaving Canada following completion of their degree, as described in the previous section. To further understand the extent to which a student's current financial status plays a role in their decision to move outside Canada, we investigated the impact of self-reported salaries, stipends and scholarship status on the likelihood of leaving Canada following degree completion.

For recent graduates, there is a significant association between decision status post-graduation and salary values. Those who have left Canada reported the highest salary levels on average (Can$113,000). Comparatively, those who remained in Canada and did not report an intent to leave reported an average salary of Can$83,000. Interestingly, those that remained in Canada but intend to leave had a significantly lower average salary of Can$67,000 which is only 60% of the salary for those that have left Canada. This suggests higher salary levels as a major factor in brain drain, as it's likely that recent graduates earning lower salaries in Canada are interested in pursuing positions abroad due to the higher earning potential and more opportunities (Fig. 4).

In alignment with this, finances/salary and available job opportunities were the highest scored importance factors for those who decided to leave Canada post-graduation and for those who intend to leave Canada, whereas for those that remained in Canada and do not intend to leave, family/friends and significant others were the highest scored importance factors (Table 1). Notably, only 4% of those who intend to leave reported being in faculty/teaching positions compared to 14% of those who remained in Canada and intend to stay (Fig. 2), which may partly explain why those who intend to leave are reporting looking for higher salaries and more job opportunities elsewhere as academic positions are highly competitive and sought-after and of limited availability.

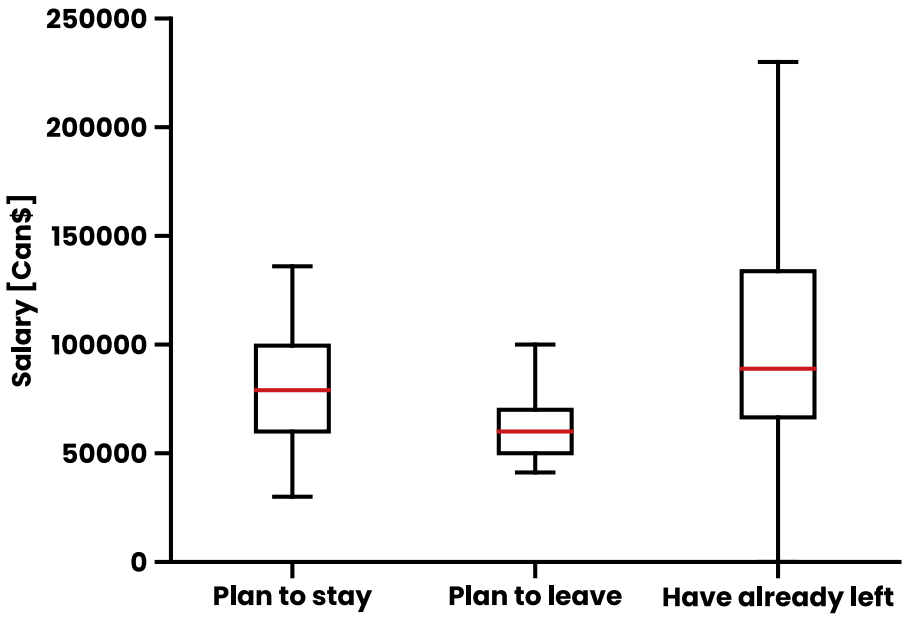



***Figure 4. The reported salary of recent graduates by their situation in Canada.***

Compared to recent graduates, self-reported stipend values and scholarship status appeared to have no impact on the extent to which current students are considering leaving Canada post-graduation. Despite scholarship status and stipend values not being associated with likelihood to leave (Fig. 5A,B), student's level of reported financial struggle do have a significant correlation (Fig 5C; $p = 0.03$). Students who reported that they were struggling financially tended to be more likely to consider leaving Canada (80%) than those who reported being comfortable financially (53%).

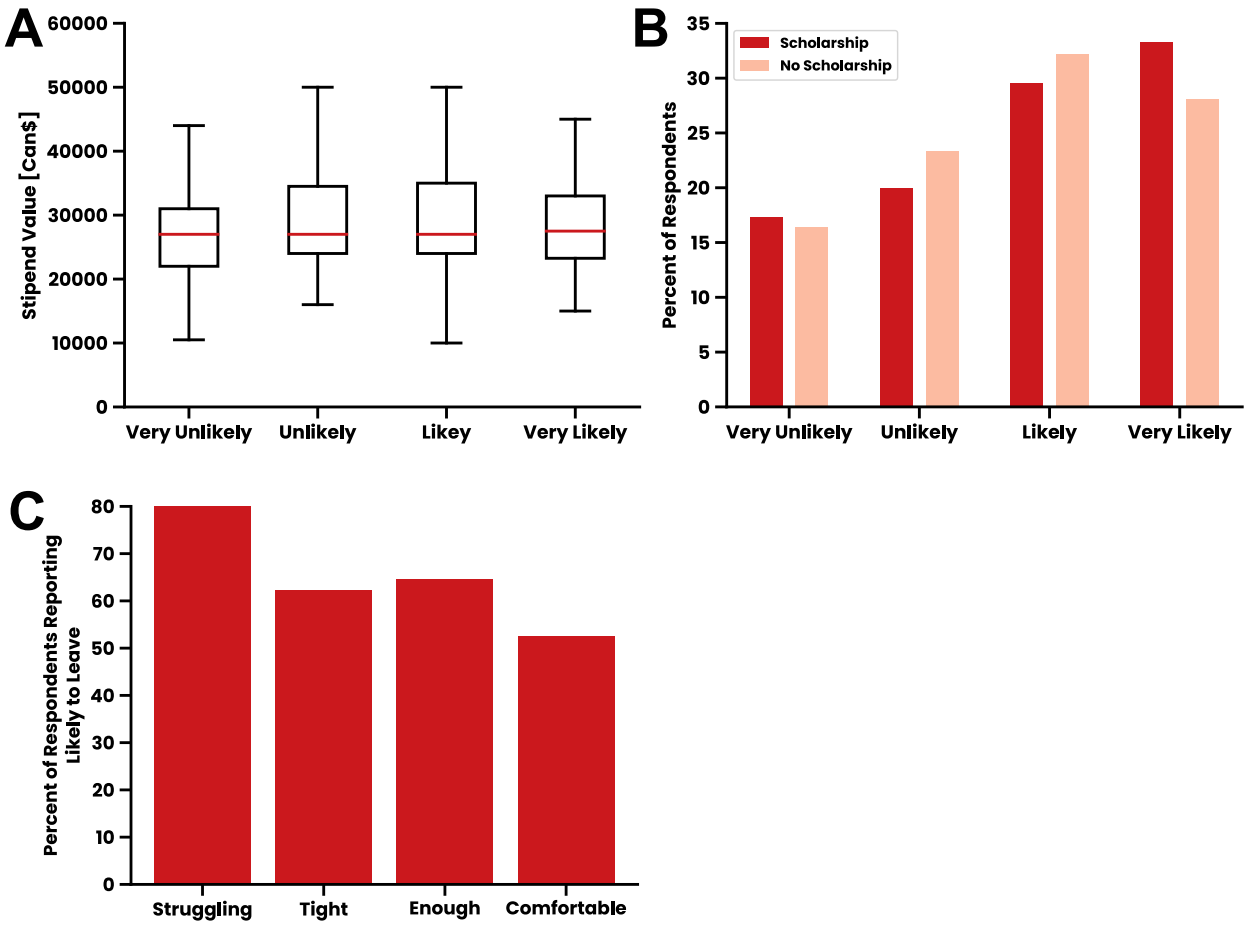
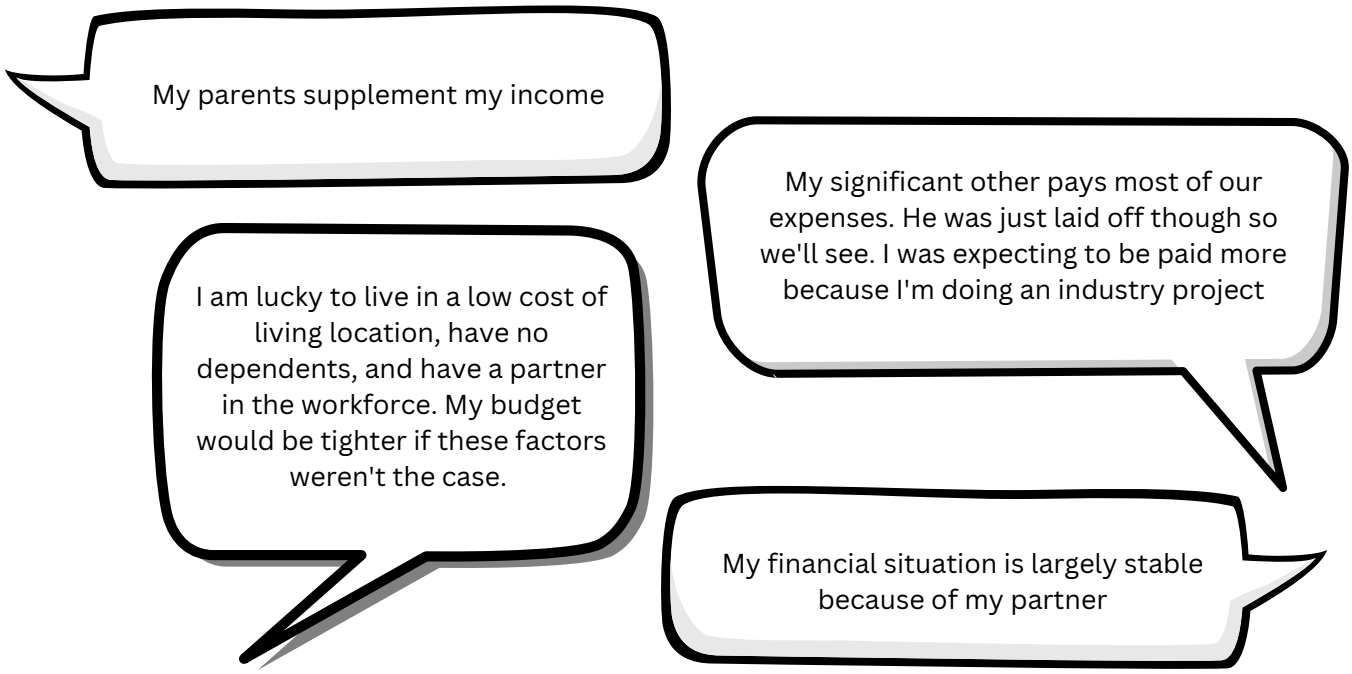



***Figure 5. Impact of stipend values, scholarship values, and financial situation on likelihood to leave Canada.*** A) The likelihood of current students to consider leaving Canada by reported stipend level. B) The likelihood of current students to consider leaving Canada by whether they hold a federal scholarship. C) The proportion of current students considering themselves Likely or Very Likely to leave Canada after completing their studies by their reported financial struggle.

Given the low value of stipends for Canadian graduate students as well as low federal scholarship amounts at the time this survey was conducted ($17,500 for Master's students, $21,000 - $35,000 for PhD students) it's possible that lack of impact of stipend or scholarship status on likelihood to leave reflects an insufficiency of federal scholarships and current stipend values to prevent students from struggling financially and looking for international opportunities to find a better financial future.

Rather, external privileges such as familial support granting better financial stability may be more impactful in allowing graduates to remain in Canada. Several comments by respondents align with this idea, for instance:




## INTERNATIONAL STUDENTS

Canada remains an attractive place to study for international students. According to the Canadian Bureau for International Education (CBIE) graduate students choose Canada for their studies because Canada is a safe and stable country, with a good reputation and quality of the education, and Canada offers a society that is tolerant and non-discriminatory. In addition, Canada offers many pathways for international students to obtain their permanent residency allowing them to enter the workforce within Canada and better the Canadian economy. In the 2021/2022 academic year according to Statistics Canada 47,829 international students were enrolled in a master's or equivalent program (21.2% of all master's students), while 23,742 international students were enrolled in a doctoral or equivalent program (38.4% of all doctoral students). As such, international students play a vital role for the Canadian economy, and keeping their talents within Canada is essential for a prosperous future.

However, Canada struggles to retain talented international students studying in Canada. A greater proportion of international student respondents reported that they were considering moving to another country (65%) than remaining in Canada (53%) or returning to their home country (34%). In addition, upon comparison to domestic students, current international students are more likely to consider leaving Canada compared to domestic students (71% to 62%, respectively).

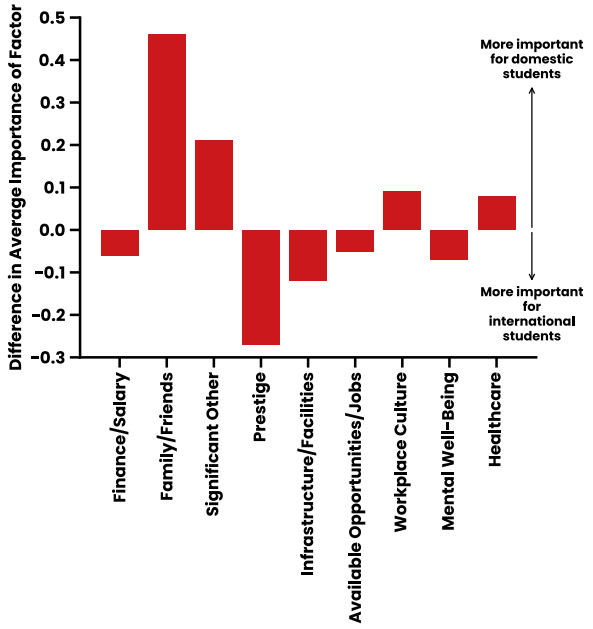



***Figure 6. The difference in the average importance of factors on their decision to remain or leave Canada between Domestic and International students.***

For international graduate students the most important factors in their decision to remain in or leave Canada were broadly similar to domestic students. However international students reported "Proximity to Family and Friends" as less important as compared with domestic students and placed a relatively higher value on "Prestige". This can likely be explained due to international students moving away from family and friends to pursue their education, this was a choice made before enrolling and may then have less of an impact on whether they leave Canada after graduating (Fig. 6).

International students are a vital part of the future economy, they bring aspirations and knowledge to sectors of the economy that are often overlooked. They choose Canada to start their academic career, opening up opportunities for them that they might not have access to from their home country. However, based on our data, international students are more likely to leave Canada than domestic students. So where do international graduate students go to pursue their career?

It appears that international graduate students are using Canada as a stepping stone for better opportunities elsewhere. Just like domestic students, international graduates are looking for better financial opportunities. Since Canada is lacking the necessary investment into research and development, both domestic and international students are looking for better financial well-being in their future career, but international students do not have the strong ties of friends and family to retain them in Canada.

## GLOBAL CONTEXT: INTERNATIONAL COMPARISON

Canada remains a competitive market for research despite lagging investment in research and development. Canada ranks second last in the G7 in expenditure towards research and development (1.55% of GDP in 2022), and has a lesser share of graduate degrees earned at 9.3% (8.2% with a master's degree or equivalent and 1.1% with an earned doctorate) compared to other G7 countries that average 13% to 15%. Beyond the G7, Canada lags behind many of our peer countries, ranking 28th in the OECD in graduate degree attainment.

This suggests that Canada is drastically undervaluing the role of research for the future Canadian economy. This is especially the case for emerging researchers who are likely to find much more generous salaries in other parts of the world - especially among the countries that were reported as the most popular potential destinations (United States, EU, United Kingdom, Australia and Switzerland) (Fig. 7).

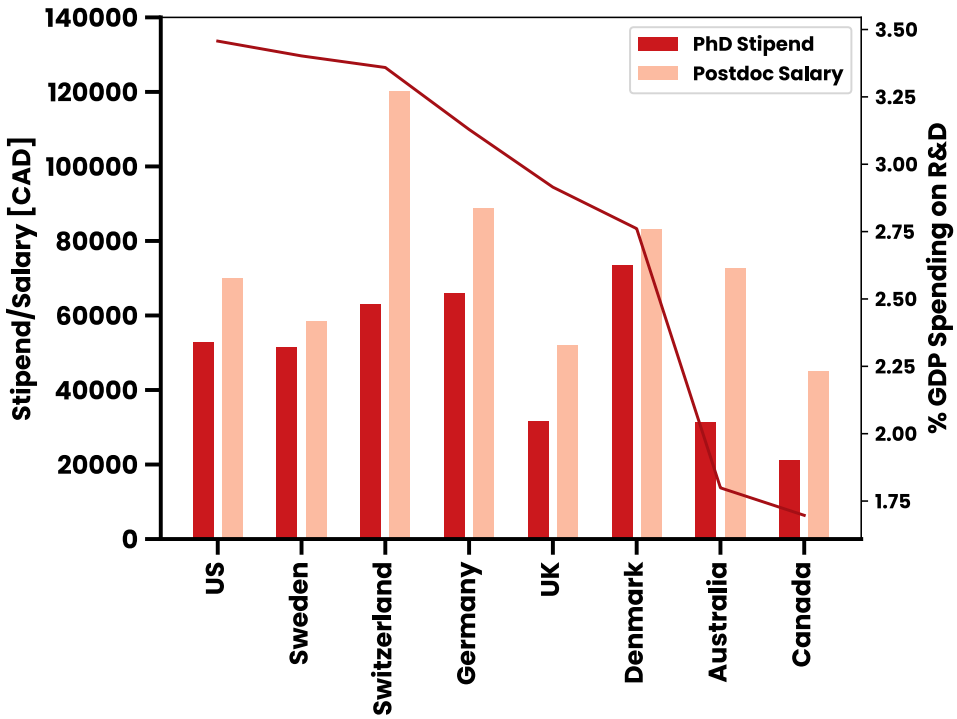
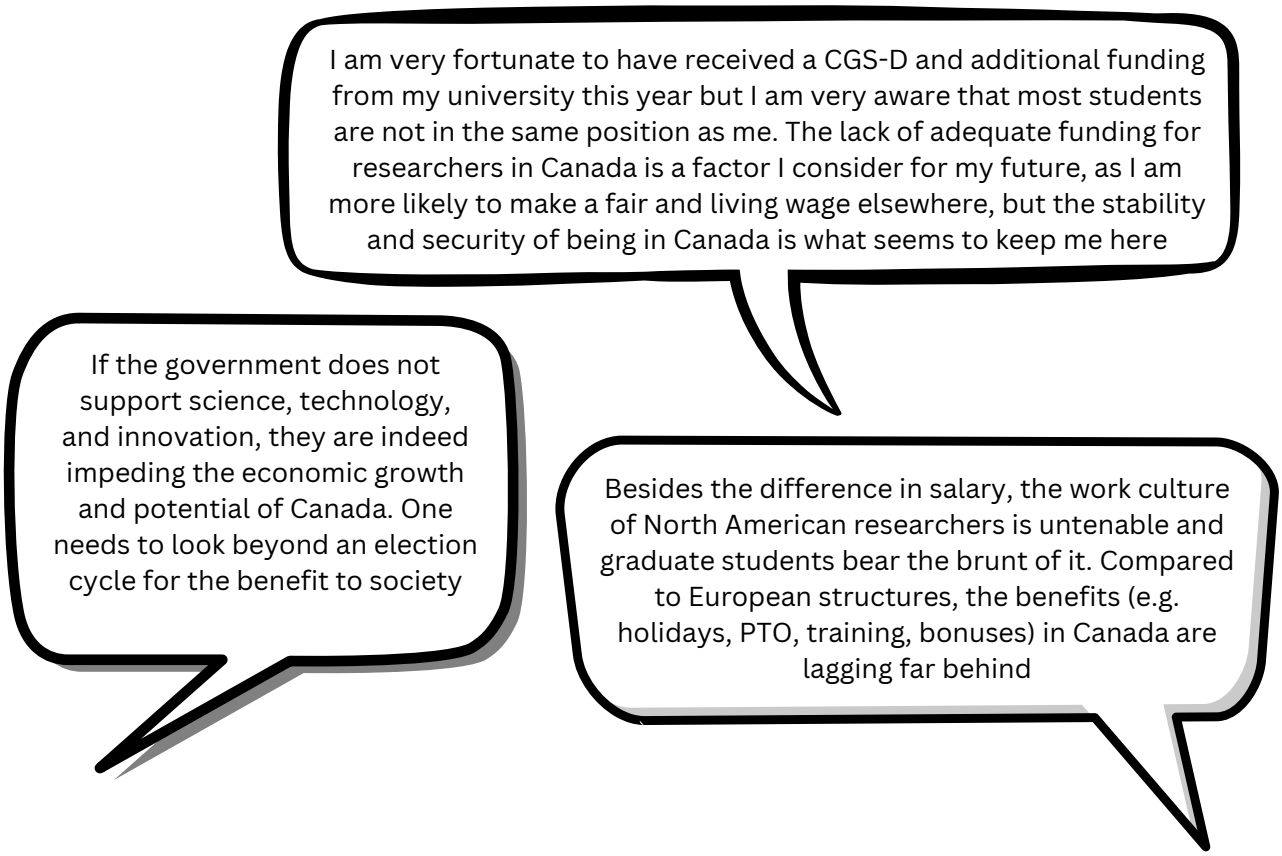



***Figure 7. The proportion of GDP invested in R&D (OECD, 2021) and typical salaries for PhD students and postdoctoral Scholars for some of the countries respondents most often reported considering moving to.***

## RESPONDENT ANECDOTES

While working on this topic, we have heard the experiences of hundreds of students and researchers from across Canada and around the world, all of whom are currently or were recently in the Canadian university system. The most common sentiment shared between them is primarily one of disillusionment and disappointment –in the lack of opportunities and support, in the lacklustre salaries and cost of living, and the lack of any significant response or solution.




## CONCLUSIONS

The study's findings illuminate the key factors behind the international mobility of holders of Canadian graduate degrees, with the appeal of better financial support and job opportunities being the most prominent factors for why graduates are considering leaving Canada.

On the global stage, graduate students are considering immigrating to countries such as the United States, EU nations (such as Germany and Denmark), and the UK due to their consistent investment in research and development, better support for emerging researchers and a more diverse research intensive private sector.

For instance, Canadian graduates have historically favoured employment in the United States, where a typical PhD salary can range from Can$52,800 to Can$65,500, compared to Can$21,000 in Canada. Similarly, postdoc salaries in the US can range from Can$70,000 to Can$85,000, surpassing the Can$45,000 typically offered in Canada (before announcements in the federal budget 2024). This trend underscores the importance of addressing this financial discrepancy and improving Canada's appeal as a compelling destination through increased research investment and competitive financial incentives, ultimately retaining top-tier talent and mitigating brain drain.

However, our survey found that many respondents were at least open to the idea of returning to Canada, with the vast majority of current students considering themselves likely or very likely to return to Canada if they did leave and just over half of recent graduates who had left or were planning to leave reporting the same. This suggests that targeted programs to increase the opportunities in research in Canada could be effective (similar to the Canada Research Chairs in the 1990s and early 2000s).

Those who have completed Canadian graduate programs are globally some of the best highly qualified personnel and could provide many of the skills that Canadian research, innovation and industry require. However, our survey suggests that Canada’s lack of investment in R&D may be causing many of these people to look elsewhere for opportunities - which if unaddressed could lead to a large brain drain and harm to the Canadian economy and society.

In the realm of research and development, the departure of graduates poses a threat to the country's capabilities and global competitiveness. The solution lies in conducive policy changes that cultivate an environment where talented graduates find encouragement to anchor themselves within the Canadian landscape. A multifaceted approach, involving increased funding for research and development, fostering collaboration between diverse sectors, and promoting a seamless transition from academia to the workforce, is critical to stemming this brain drain.

# APPENDIX

## SURVEY DEVELOPMENT

The “Investigation into the Mobility of Canadian Graduates'' was conceptualised and designed by members of the Ottawa Science Policy Network (OSPN). The goal of the survey was to provide insight into how current graduate students and those who have recently completed these studies are planning and thinking about working internationally. Survey questions were carefully designed carefully and best efforts were made to frame the questions objectively. The survey questions can be found in the supplemental file. According to the Tri-Council Policy Statement (TCPS-2), ethics review/approval was deemed unnecessary as “ethics review/approval is not required for projects that are considered Quality assurance and quality improvement studies, as these don’t typically meet the purpose of research”. Article 2.5 of the TCPS-2 states “Quality assurance and quality improvement studies, program evaluation activities, and performance reviews, or testing within normal educational requirements when used exclusively for assessment, management or improvement purposes, do not constitute research for the purposes of this Policy, and do not fall within the scope of REB review”.

## DATA POLICY

Responses to the survey are held as in confidence by the Ottawa Science Policy Network (OSPN), a student organisation at the University of Ottawa. Aggregated, anonymous, or de-identified data may be shared with representatives of student associations, university administrations, advocacy groups, legislatures, and governments across Canada, including data subsets where appropriate.

Although we did not collect identifying information (e.g., such as names), individuals may still be identifiable by combining data. To protect anonymity, we will only publish or share subsets of data generated by combining responses of 2 or more questions when there are at least 5 responses in all categories. Any numerical data will only be published or shared as summary statistics (for instance, mean and standard deviation) or as binned data (such as a histogram). Responses will never be shared or published in such a way that link together all an individual’s responses.

Raw data collected in the survey will be retained for a period of seven years after which it will be deleted. Any data published or shared with other organisations will be retained indefinitely. Once analysis of the data has concluded, access will only be granted to the OSPN president (or other OSPN members that the OSPN executive determines are responsible for custody of the data).

## DATA PRE-PROCESSING

Data preprocessing occurred prior to analysis. Based on the unique identifiers provided for each survey entry and demographic information, some respondents were determined to be duplicates (i.e., the same individual filled in the survey twice) and were removed. As data analysis was performed in English, all French responses were translated into English. Numerical data was transformed into a consistent format (e.g., removing comma separators and $ symbols), but no numerical values were changed. In the cases where the authors felt there was an obvious entry error or possible misunderstanding of the question, the responses were excluded from the analysis of that question.

For certain questions, where a freeform response had been an option, responses were classified into groups to better enable comparisons. This was done for the following survey sections: gender identity Q5, field of study Q11, current level of study Q14. These classifications, effort was taken to retain the meaning of a response, especially for demographic information, and reclassification was based on all the information available and best judgment. A copy of the unprocessed survey answers has been preserved.

## STATISTICS AND DATA VISUALIZATION

Throughout this report we used a significance threshold of 5% (i.e., $p<0.05$). This means that for findings to be claimed as significant, there is a greater than 95% probability that any difference we detected is not solely just due to random variation in sampling. However, it does not provide any information about why two (or more) groups may differ and does not take into account possible underlying factors — only that the difference is unlikely to be due to statistical chance alone. For comparing categorical data, the chi-squared (chi2) test was used using the categories presented in the plot or other summary data. For numerical data comparisons, a two-sample Kolmogorov–Smirnov (KS) test, T-test, Mann-Whitney U test or Kruskal–Wallis (KW) test were used. When comparing more than two categories, the statistical test does not provide information about how or which categories differ — only that the total extent of differences seen are unlikely to be due to randomness of sampling.

All figures were generated with the matplotlib library in python.